International Journal of Electronics,
Communication & Instrumentation Engineering
Research and Development (IJECIERD)
ISSN(P): 2249-684X; ISSN(E): 2249-7951
Vol. 4, Issue 2, Apr 2014, 47-52

TRANS STELLAR
• Journal Publications • Research Consultancy

STUDY ON DATA COMMUNICATION THROUGH HUMAN BODY

AMARNATH GAIKWAD[1] & J. W. BAKAL[2]

[1]Department of EXTC, SSJP, Asangaon, Shahapur, Maharashtra, India

[2]Principal, SSJCOE, Dombivli, Maharashtra, India

ABSTRACT

Human body can be proved a better communication medium for near field communication where transmitter and receiver are in close proximity. Human body can be represented with an electrical circuit because tissues are made of cells and human body consists of cells. In human body there is presence of iron, calcium etc. which are conductive in nature so as the current is passed through the body so the signal also can be transmitted through the body. This paper describes the model of human networking technology that enables communication by touching. Data from one device to another is transferred through a soft-ware via Bluetooth model to circuitry. From circuit data reaches to metal pad and via body it is transferred to another device.

KEYWORDS: Body Area Network, Communication, Human Body, Intra body Communication, Near Field Communication, Wireless Communication

INTRODUCTION

"Data communication through human body" is a combination of hardware and software protocol. Wireless body area networks around the human body are expected to play an important role in various area of applications such as in the monitoring of health, sports training, interactive gaming, sharing of personal information, security authentication and medical information systems. Intra body communication is a technique that uses the human body as a transmission medium for electrical signals providing an efficient channel to interconnect different devices within body sensor networks and presenting notorious advantages in comparison with the usual wireless standards such as Bluetooth or ZIGBEE [1]. This new wireless communication technology will be useful in communication. This method can be used to create a wireless network among on body devices or between on body devices and a reachable device.

Communication between electronic devices on the human body (wearable computers) and ones embedded in our everyday environments is also critical, so this has driven extensive research and development on human area networks. Research is progressing towards the antenna design for wearable computing so to communicate different devices on human body. Now a day communication between different machines is very much important in the human health monitoring system while the patient is in emergency situation. At that time so many wires are connected to the human body and these wires connected to the different sensors with the body. There a mesh of wires is created nearby the patient's body. Wireless technology can't be used in such a situation because wireless devices causes radiation and that can be hazardous to the human health. So the need of such a communication system is felt so that the communication between different devices which are observing the human health must be smoothly without creating any hazard to the human health. As a result the new communication technique is observed which is using the human body as a medium so that all the mesh of wires can be removed as well as the hazards of wireless also can be overcome.

Here a prototype for the communication through the human body is shown. First data is in one device which is transferred to the circuit which consists of ARM processor through the Bluetooth. From here via body this data is passed to the other device very smoothly without any error. For the operation of the circuit power requirement is also low. So in such a manner data transmission is done using the human body as a medium for biomedical monitoring system.

BACKGROUND OVERVIEW

The first step towards the communication through human body started in 2007, where an attempt was done to communicate between the on body sensors. The sensors which were in close proximity to each other with human body a set up was created and using the wireless technology as Bluetooth was used to communicate between sensors. After this so many methods were described regarding the analysis of human body characteristics. Human body work as an impedance model or can be a resistive network. Also the human body characteristics in the electromagnetic field are explained.

Human body can approximately be considered as a conductor wrapped in an insulator [3]. Electro optic sensors were used here to demonstrate the communication system. Communication was totally between the EO sensors which are the sensors which sense the light or change of light and produce an output accordingly. Human body also can be considered to pass the electromagnetic waves. The elucidation of mechanism of the human body surface transmission was made from an electromagnetic field approach [4]. A new approach for analysis of body characteristics is given based on electromagnetic waves using Maxwell's equations. Relative permittivity and conductivity is calculated on different frequencies. Basically here an equivalent model is considered which is similar to human body. Electric field distribution is also obtained but not the magnetic field distribution. Attenuation constants are also calculated based on the theoretical model by the numerical method.

A simple but accurate model based on a distributed-parameter circuit that joins simplicity with flexibility to match diverse experimental results, is presented regarding both attenuation and dispersion characteristics, those are key parameters in the communication performance [5]. Attenuation is the gradual loss in intensity of any kind of flux through a medium. Sunlight can be attenuated by the dark glasses and sound can be attenuated by the water. Human body consists of different - different material like blood, bone, fat, muscle etc. and each have different attenuation constant. Dispersion is the change of index of refraction. Dielectric dispersion is the dependence of the permittivity of dielectric material on frequency [5].

Existing System

Now a day, suppose we want to transmit the data between two computers then we can transmit by using some other means. First we will have to copy that data into external storage device and then from that external storage device it can be transferred to another computer. Or second option is to share the computers on LAN. But to share on LAN it is complicated process. And by using external storage it is time consuming process. It is also not possible to send the data from one computer to another by just connecting by USB data cable because there is some protocol required to share the data by this process. If we want to share the data on two mobile devices then it is possible by using facility of Bluetooth, but it takes time to share data. The destination device should be in line of sight and discoverable.

Drawbacks of Existing System

First the data transmission speed is less. Second, when the wired network is used for communication routing need to be done and protocol requirement is also there. Data transmitted wirelessly is not secure enough.

Proposed System

The drawback of the existing system is eliminated using SPARSH because in this system data is transmitted using body as a medium. By touching the hardware connected with the device we are able to transmit the data. Here, we are eliminating the problem of routing cable, radiation of signal because the data is transmitted within the body, it is the secure transmission because no unwanted signal interception, and the power consume by the system is also reduced.

THE PROPOSED MODEL

The experimental block diagram is shown below in the figure which gives the basic idea about the proposed model for the system "Data communication through Human Body".

Block Description

Description for each block is given below where brief details are given regarding each block.

Power Supply

This unit is the first important block which provides the power requirement to each block. In any circuit designed there are different components and elements which need the different power requirement for their operation. Here the main supply is the ac mains 230 volts supply which is converted to dc supply and different voltages. Typical requirement for operation is 5V dc supply which is obtained using rectifier circuit.

Mobile Device

Mobile device is required to develop an android application so that the communication between the two devices can be shown practically happening. Now a days android operating system is used in large scale so this system is chosen here. Android is the user friendly operating system which directly provide the graphical user interfaces inbuilt at the time of development and writing code and designing application. Mobile device is connected to Bluetooth modem of the circuit can communicate with mobile.

Bluetooth

This unit is the intermediate unit. This unit works to transfer the data from the mobile device to the system developed.

ARM

Processor is the heart for any system. Here ARM processor is used to design the system because it is advantageous over the normal microcontroller IC in different ways. This is responsible for monitoring and control of all the peripheral devices which are connected in the system and for the data transfer from one unit to another unit.

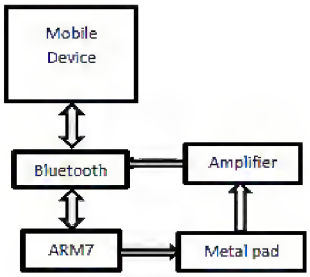

Figure 1

Amplifier

This unit is used to amplify the signal strength which is received at touch pad. Because the signal received at touch pad is having low strength so it can't be transferred directly. There is need to amplify the signal strength. IC LM358 is used for the amplifier circuit.

Metal Pad

This unit is nothing but the square block of copper. From this block the data will be transferred into the body and is received from the body.

Working

The data which is to be transferred from one mobile device is selected and by using the application developed for the data transmission is selected and transferred. Data from mobile device is reached to the system via Bluetooth. Here data reached at ARM processor and transferred first to the metal pad and from metal pad the data is transferred to the human body. Here human body works as a medium for data transmission, and data is reached at metal pad of another system developed. From here data reached at amplifier where the signal is amplified and transmitted to the ARM and from ARM processor it is sent to the Bluetooth modem. It is connected to the mobile device where an application is developed and data is reached to the mobile device. The above process is repeated and the data is shown on the mobile device. Both the devices should have the application and then the data can be transferred and seen.

EXPECTED RESULTS

Overall system development is needed first the proper understanding of the blocks and concept which is being developed. All we know that human body works as conductor and current can be transferred from human body. Whenever we apply the voltage at our one hand and if we measure the voltage across second hand then we find that there is some voltage drop across the human body. So it can be concluded that human body can be considered as an impedance block.

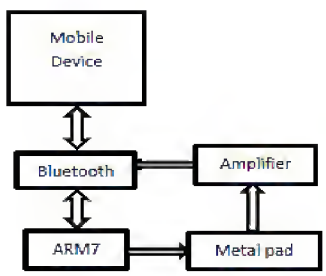

Figure 2

When the 5V supply is applied at one hand of the body and voltage drop is measured at another hand of the body then it is found that 2.8V value is observed. So this system also works as same above. If voltage being a signal can be transmitted then it is also possible to transmit the data.

CONCLUSIONS

It is an exciting technology. The system which is being developed for data communication is very helpful. Here human body works as a medium for data communication. Our main objective is to design a system which is supportive for two way communication.

REFERENCES

1. Maria AmparoCallejon, David Naranjo-Hermandez, Javier Reina-Tosina and Laura M. Roa, "A comprehensive study into Intra body communication Measurements" IEEE transaction on Instrumentation and Measurement, vol. 62, no. 9, September 2013.
2. M. S. Wegmueller, A. Kuhn, J. Froehlich, M. Oberle, N. Felber, N.Kuster, and W. Fichtner, "An attempt to model the human body as a communication channel," *IEEE Trans. Biomed. Eng.*, vol. 54, no. 10, pp. 1851–1857, Oct. 2007.
3. A.-I. Sasaki, M. Shinagawa, and K. Ochiai, "Principles and demonstration of intra body communication with a sensitive electro-optic sensor, *IEEE Trans. Instrum. Meas.*, vol. 58, no. 2, pp. 457–466, Feb. 2009.
4. J. Wang, Y. Nishikawa, and T. Shibata, "Analysis of on-body transmission mechanism and characteristic based on an electromagnetic field approach," *IEEE Trans. Microw. Theory Tech.*, vol. 57, no. 10, pp. 2464–2470, Oct. 2009.
5. M. S. Wegmueller, M. Oberle, N. Felber, N. Kuster, and W. Fichtner, "Signal transmission by galvanic coupling through the human body," *IEEE Trans. Instrum. Meas.*, vol. 59, no. 4, pp. 963–969, Apr. 2010.
6. M. Callej´on, L. M. Roa, J. Reina-Tosina, and D. Naranjo-Hernandez, "Study of attenuation and dispersion through the skin in intra body communications systems," *IEEE Trans. Inf. Technol. Biomed.*, vol. 16, no. 1, pp. 159–165, Jan. 2012.
7. M. A. Callejon, D. Naranjo-Hernandez, J. Reina-Tosina, and L. M. Roa, "Distributed circuit modeling of galvanic and capacitive coupling for intra body communication," *IEEE*
8. Z. Lucev, I. Krois, and M. Cifrek, "A capacitive intra body communication channel from 100 kHz to 100 MHz," in *Proc. IEEE Instrum. Meas. Technol. Conf.*, May 2011, pp. 1–4.
9. L. Wang, G.-Z. Yang, J. Huang, J. Zhang, L. Yu, Z. Nie, and D. R. S. Cumming, "A wireless biomedical signal interface system-on-chip for body sensor networks," *IEEE Trans. Biomed. Circuits Syst.*, vol. 4, no. 2, pp. 112–117, Apr. 2010.
10. H. Baldus, S. Corroy, A. Fazzi, K. Klabunde, and T. Schenk, "Human centric connectivity enabled by body-coupled communications," *IEEE Commun. Mag.*, vol. 47, no. 6, pp. 172–178, Jun. 2009.

11. G. Koutitas, "Multiple human effects in body area networks," *IEEE Antennas Wireless Propag Lett.*, vol. 9, no. 5, pp. 938–941, Apr. 2010.

12. S.-J. Song, N. Cho, and H.-J. Yoo, "A 0.2-mW 2-Mb/s digital transceiver based on wideband signaling for human body communications," IEEE J. Solid-State Circuits, vol. 42, no. 9, pp. 2021–2033, Sept. 2007